Recommendation 1005, RBW for NGSO MSS feeder links in the bands lightly used by FSS may not need to be additionally constrained.

4.4.4 Frequency Sharing Between NGSO MSS Feeder Links for MSS Systems Intending to Operate Service Links in the 1-3 GHz MSS Bands and the Aeronautical Radionavigation Service (ARNS) in the 5000-5250 MHz Band

4.4.4.1 Sharing between NGSO MSS feeder links for MSS systems intending to operate service links in the 1-3 GHz MSS bands and MLS

The band 5000-5250 MHz is allocated to ARNS. The Microwave Landing System (MLS), as developed in accordance with ICAO standards, has precedence over all other uses of this band (RR 796). RR 953 states that the safety aspects of radionavigation require special measures to ensure their freedom from harmful interference. There is a strong interest in using this band or part of this band for MSS feeder-links for MSS systems intending to operate service links in the 1-3 GHz MSS bands.

In the uplink direction, preliminary studies have shown that co-frequency sharing between MLS and NGSO MSS feeder link earth stations, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, may be technically feasible with a minimum coordination distance at least 400 km from MLS sites, assuming similar altitudes of the MLS and MSS sites.

Recognizing the critical safety aspects of MLS, it is preferable for NGSO MSS feeder-links of MSS systems intending to operate service links in the 1-3 GHz MSS bands and MLS to use non-overlapping spectrum particularly in geographic areas where coordination between the two system is not feasible. MLS use coordinated by ICAO currently occupies the band 5030-5091 MHz and in the future is planned to occupy 5030-5150 MHz. In principle, MLS may be reorganized in the future in the band 5000-5120 MHz. ICAO has indicated that such reorganization could be given favorable consideration. Accommodating MLS in the band 5000-5120 MHz would then yield 130 MHz of contiguous spectrum for NGSO MSS feeder links, for MSS systems intending to operate service links in the 1-3 GHz MSS bands,

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that would not overlap MLS in frequency. It is estimated that use of the band not overlapping MLS channels results in restricting MSS feeder link earth stations from operating within about 50 km from each MLS site.

Prior to the future need of additional channels for MLS as identified by ICAO, it may be feasible for MSS feeder links, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, to use the band 5000-5030 MHz and 5090-5120 MHz if an appropriate regulatory procedure is adopted by a WRC to accommodate MLS expansion into this portion of the band if and when MLS requires additional channels in this band.

Sharing within the MLS-channelled band, although technically feasible, would require coordination on a case by case basis with great care to ensure the integrity of MLS. In-band sharing will require either (1) operation beyond radio horizon; or (2) terrain blocking along with other possible mitigation techniques that offer high integrity (i.e. consistent with the requirements of MLS). Among these techniques, terrain blocking will play a special role as being a technique that is not subject to failure or human error. Active monitoring and automatic feeder link transmitter shutdown, in the case of monitoring threshold exceedance, will most likely be required to ensure MLS integrity under all conditions. Theoretical analyses must be augmented by practical tests before these techniques can be endorsed. Further studies are required before any conclusions can be made.

In the downlink direction, sharing with NGSO MSS feeder links, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, would be feasible if NGSO MSS satellite emissions are constrained by an appropriate PFD limit at the MLS equipped aircraft.

It should be noted that the MLS interference threshold should not be exceeded by the aggregate of all relevant signals, including uplink and downlink feeder links which share the band.

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4.4.4.2 Sharing between NGSO MSS feeder links for MSS systems intending to operate service links in the 1-3 GHz MSS bands and other services

Other aeronautical services have been identified in the band 5000-5250 MHz that may require protection from NGSO MSS feeder link emissions. No study has been made so far to assess the feasibility of sharing those other services with NGSO MSS feeder links, for MSS systems intending to operate service links in the 1-3 GHz MSS bands.

Non-ICAO MLS systems are mainly used for landing naval aircraft on land and ships. The level of protection required for such a system is expected to be less stringent than for the ICAO standard MLS but is yet to be determined. A Non-ICAO MLS system has been identified by one administration but its deployment in other countries is not known at the present time.

There are plans in at least one administration and in ICAO for wind shear radar, automatic dependent surveillance air/ground data link and DGNSS ground/air data link, but sharing criteria are not yet developed.

Administrations should consider the continuing need for Aeronautical Mobile-Satellite (R) Service, Fixed-Satellite Service and Inter-Satellite Service, and the possibility of sharing it with NGSO MSS feeder links, for MSS systems intending to operate service links in the 1-3 GHz MSS bands.

Sharing with RDSS feeder links in the band 5150-5216 MHz is similar to the sharing with NGSO MSS feeder links (case of NGSO/RDSS system) or GSO FSS (case of GSO/RDSS system).

4.4.5 Frequency Sharing Between Multiple NGSO MSS Feeder Link Networks for MSS Systems Intending to Operate Service Links in the 1-3 GHz MSS Bands

Studies to date have shown that sharing between two NGSO MSS feeder links, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, is feasible.

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However, conclusions pertaining to more than two NGSO MSS systems sharing the same feeder link frequencies have not been agreed internationally. The results of these types of studies are critical in determining the total spectrum requirements for multiple NGSO MSS feeder links for MSS systems intending to operate service links in the 1-3 GHz MSS bands.

4.4.5.1 Summary of Results from Recent Analyses and Computer Simulations

In the U.S. four analyses and computer simulations have been conducted recently to determine the upper bound to the interference statistics resulting from "in-line" or main beam coupling between the feeder links of a NGSO MSS reference system and those of one or more other NGSO MSS systems, intending to operate service links in the 1-3 GHz MSS bands, operating their feeder links co-directionally in the same frequency band as the reference system. Although, the approach and methodology in each of the referenced analyses are similar, they are not identical. Nevertheless, all four analyses reach the same conclusion that at least two NGSO MSS feeder link systems, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, can successfully share the same spectrum without significant adverse operational impact using some mitigation techniques. Significantly more mitigation measures would be needed to enable more than two systems to share the same spectrum.

4.4.5.2 Summary of Mitigation Techniques

For two or three NGSO MSS systems interfering into a reference NGSO MSS feeder link system, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, the total interference time (depending on the reference system) is on the order of 5000 to 6000 seconds or 0.02% of the time. By way of comparison, total yearly sun transit outage time for GSO systems is on the order of 7000 seconds.

All analyses to date indicate that total interference time, relative to any set of reference feeder links, is simply the sum of the (single-entry) interferences from each of the individual feeder links. Thus, if multiple NGSO MSS systems, intending to operate service links in the 1-3 GHz MSS bands, share common spectrum co-directionally, and fail to apply appropriate mitigation techniques (identified below), the total interference time can be

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expected to be on the order of the sun transit outage time for GSO systems, or possibly a small multiple of this time. This is potentially acceptable, however, straightforward mitigation techniques exist which can dramatically reduce the total interference time as well as the impact of the interference. Several such techniques are identified in Table 1 below.

A substantial range exists relative to the potential reduction in interference time achievable through known mitigation techniques. First of all, it is important to emphasize that the operational interference time is less than the geometric interference time due to traffic loading statistics and inherent margin in the system. Furthermore, when diversity is available, interference on a single satellite may exist but be operationally insignificant. Operationally significant interference time can probably be reduced substantially if all mitigation techniques described above are considered in aggregate. Thus, even under worst case conditions and for worst-case pairings of NGSO MSS systems, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, operationally significant interference time can be held to a fraction of the sun transit outage time experienced by GSO systems.

It is not necessary for all NGSO MSS systems, intending to operate service links in the 1-3 GHz MSS bands, to implement all mitigation techniques. Indeed it appears that each MSS operator has a number of options which can be used independently without having to resort to extensive coordination with other MSS operators in order to share common feeder link spectrum. This sharing of feeder link spectrum will help to significantly reduce the feeder link spectrum requirements of the MSS.

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TABLE 1

List of mitigation techniques to reduce frequency and duration of interference events

Technique	Explanation	Penalties/Shortcomings
1) Bigger gateway Antennas	Bigger antennas mean smaller beamwidth which reduces the chances of main beam coupling	More expensive antenna. Some potential offset due to reduction in HPA power, reduced self-noise.
2) Beam steering	Steer gateway antenna boresight away from interfering or victim spacecraft by small fraction of a beamwidth	Reduction in desired carrier power.
3) Satellite diversity	Using a second satellite when the first is experiencing an interference event	Requires second satellite in view and capability to appropriately switch traffic. Reduces degree of diversity available to mitigate other link impairments.
4) Gateway diversity	Using a second gateway when the first is experiencing an interference event	Requires second gateway in view and capability to appropriately switch traffic. Reduces degree of diversity available to mitigate other link impairments.
5) Traffic Management (CDMA Systems)	Temporarily reduce traffic through "in-line" event to create link margin for excess RFI flux density from interfering system. Interference during periods of non-peak traffic may be tolerable without active mitigation	Potential impact on quality of service.
6) Outage tolerance	Designing systems that can tolerate outages lasting up to 20 seconds will minimize the impact of an interference event	Potential impact on design of gateway and user terminal (MES) hardware and software.
7) Gateway Location	Avoid latitudes that seem to maximize the chances of main beam coupling ($\sim 40^{\circ}$ N)	Potential requirement for additional gateways to compensate for avoidance of specific geographic bands.

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8) Nulling	Active adaptive nulling within the main beam can eliminate interference except for a small region on boresight	Much more expensive gateway antenna subsystem.

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4.5 Regulatory/Procedural Provisions for NGSO MSS Feeder Link Networks for MSS Systems Intending to Operate Service Links in the 1-3 GHz MSS Bands

4.5.1 Introduction

The regulatory provisions of Article 1 (RR-22) which allow the operation of the feeder links for other space Radiocommunication services in the Fixed-Satellite Service, and certain regulatory provisions in Articles 8, 11 and 29, currently do not provide a commonly agreed interpretation for the accommodation of NGSO MSS feeder link networks for MSS systems intending to operate service links in the 1-3 GHz MSS bands. It is evident, based on the existence of conflicting interpretations of these elements of the Radio Regulations, and the fact that the BR does not apply RR 2613 in the examination of Appendix 3 notifications, that certain revisions are required.

There is a general recognition that both the GSO FSS satellite networks and NGSO MSS feeder link networks, intending to operate service links in the 1-3 GHz MSS bands, must have a regulatory base which permits their orderly operation without any regulatory uncertainties to their full operational life.

This Section of the Report identifies some regulatory changes that could achieve this goal. Other Sections of this Report define the practical levels of co-channel, co-directional and bi-directional sharing that are operationally possible for these two services. The regulatory changes described in this Section are, in part, based on these defined sharing opportunities.

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4.5.2 Possible Regulatory/Procedural Revisions

4.5.2.1 General

The possible regulatory revisions could include the following:

a) changes to Article 8 to identify qualifications for the use of certain frequency bands allocated to the FSS;

b) in designated frequency bands, in order to establish equity, Article 11 and/or Resolution 46 to include NGSO MSS feeder link networks, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, in the same regulatory procedures that are currently applied to GSO FSS networks;

c) any consequential changes to other regulations as appropriate.

4.5.2.2 Changes to Article 8

Some of the allocations to the Fixed Satellite Service could be qualified in a manner which will accommodate NGSO MSS feeder link networks, for MSS systems intending to operate service links in the 1-3 GHz MSS bands . These qualifications in the Table of Frequency Allocations could be used to provide the type of frequency usage described in the sharing opportunities defined in this Report. In addition to these qualifications, for some of the current FSS allocations, there could be an additional allocation to the FSS in the reverse direction in the same frequency band.

The accommodation of the NGSO MSS feeder link spectrum requirements, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, can be addressed differently in frequency ranges below and above 17.7 GHz.

4.5.2.2.1 Bands Below 17.7 GHz

Because of the difficulty of co-direction sharing of frequencies between NGSO MSS feeder links, for MSS systems intending to operate service links in the

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1-3 GHz MSS bands, and GSO FSS space networks, it is envisioned that below 17.7 GHz the NGSO MSS feeder link networks would use certain bands allocated to the FSS and would have a priority status over GSO FSS networks in a specific transmission direction. Regulatory provisions would be needed to make this usage by GSO FSS networks and NGSO MSS feeder link networks clear. Specific regulatory language would need to be developed in order to resolve any sharing difficulties when there are allocations of equal status in opposite directions.

In this regard, it has been assumed that, below 17.7 GHz, specific changes would be made by WRC-95 to Article 8 to accommodate the need to have certain priority for FSS allocations that would be used for NGSO MSS feeder links, for MSS systems intending to operate service links in the 1-3 GHz MSS bands. In any FSS allocation to which this priority approach would not be applied, e.g. because it is heavily used by GSO FSS systems, RR 2613 would be maintained. The following provides a specific example of how such an approach could be implemented in the present Article 8. It should be noted that this approach was retained in the output report from the CPM-95.

In this example, the use of bands allocated to the fixed-satellite service by NGSO MSS feeder links on a primary basis, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, is restricted to bands and direction of transmission specifically identified for such links. In other FSS bands, or in a transmission direction not identified for NGSO MSS feeder links, the use of NGSO feeder links, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, shall not cause unacceptable interference to or receive protection from GSO FSS networks. To accomplish this principle, WRC-95 could add a footnote to specific FSS bands that are to be used for NGSO MSS feeder links as follows:

- the existing primary allocation to the FSS in the band of interest in the regular direction is kept as is;

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- the band is allocated on a primary basis to FSS in the reverse direction,but this allocation is restricted to NGSO MSS feeder links for MSS systems intending to operate service links in the 1-3 GHz MSS bands;
- RR 2613 is waived in this band, but only for NGSO MSS feeder links in the reverse direction;
- Res. 46, suitably modified, applies in the band, between the GSO FSS networks in the existing FSS allocation and the NGSO MSS feeder links in the new FSS allocation, between the NGSO MSS feeder links in the new FSS allocation, and between the NGSO MSS feeder links in the new FSS allocation and the terrestrial services.

The following regulatory options are identified:
Sharing with GSO FSS networks is feasible if RBW mode is used.

In frequency bands and directions of transmission specifically identified for NGSO MSS feeder links, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, a footnote should specify the exact regulatory provisions which are applicable.

Coordination between a NGSO MSS feeder link earth station and a GSO earth station operating in the opposite direction of transmission should be covered in suggested changes to Resolution 46.

Coordination between a NGSO MSS feeder link space station, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, and a GSO space station operating in the opposite direction of transmission can be handled preferably, via the addition in Article 29 of pfd limits to be met by NGSO space stations of a given constellation in the direction of the GSO (e.g. -168 dB(W/m^2/4 kHz)). There has been some concern expressed about the possible application of such a network

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limit when pointing within five degrees of the GSO as opposed to the normal limit to individual stations.

To take an example, if the band [xxx] is presently allocated on a primary basis to the FSS (Earth-to-space), the following additions would be made to Article 8 table of allocations:

- in the Table of Article 8, FSS (space-to-Earth) primary in the band [xxx], with a new footnote yyy;
- in a footnote yyy associated with this new allocation: "The use of the band [xxx] by the FSS (space-to-Earth) is limited to NGSO MSS feeder links. The provisions of RR 2613 do not apply for this FSS (space-to-Earth) allocation;
- an additional footnote zzz is inserted for both the current and the new FSS allocations: "The use of the band [xxx] by the FSS is subject to the application of the coordination and notification procedures set forth in Resolution 46 (suitably modified), for the coordination between GSO networks (Earth-to-space) and NGSO networks (space-to-Earth), between NGSO networks (space-to-Earth) and between NGSO networks (space-to-Earth) and terrestrial services."

This approach would imply that the present priorities between services in the current allocations would be kept unchanged: RR 2613 would still apply to NGSO FSS including NGSO MSS feeder links, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, in the Earth-to-space direction, for which Resolution 46 (suitably modified) would not be applied.

If the bands corresponding to the FSS Allotment Plan are considered by WRC-95 for a new allocation to the NGSO MSS feeder links, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, protection of the plan would need to be ensured by specific provisions.

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4.5.2.2.2 Bands Above 17.7 GHz

Co-Directional Allocations

Several options were identified as possible ways to satisfy the NGSO MSS feeder links in specific frequency sub-bands.

In the first option, because these allocations are lightly used at present, some of these bands could be provided with a footnote which permits all of the above systems on an equal basis. Such a footnote would exempt NGSO MSS feeder links, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, in the FSS allocation from the application of RR 2613 (S22.2), and substitute a coordination procedure such as Resolution 46, or a modified version of Article 11 (S9). The applicable sharing criteria and standards to be used with this procedure would be specified in the RR to provide equitable and efficient sharing between GSO FSS and NGSO MSS feeder link networks, intending to operate service links in the 1-3 GHz MSS bands. Thus, once a NGSO MSS feeder link system or a GSO FSS system has been coordinated, it would have full rights to protection from GSO FSS and NGSO MSS feeder link systems previously coordinated or subsequently proposed for operation in the same band. This option may extend the kind of provisions that now exist for GSO FSS networks to NGSO MSS feeder link networks, for MSS systems intending to operate service links in the 1-3 GHz MSS bands.

For the second option, it was recognized that in the bands above 17.7 GHz, while sharing is feasible with NGSO MSS feeder link networks, intending to operate service links in the 1-3 GHz MSS bands, having specific characteristics and specific operational capabilities, this type of sharing may create the existence of geographic exclusion zones around both the GSO FSS and NGSO MSS feeder link earth stations which is considered constraining on both FSS applications. Co-directional

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sharing also requires the NGSO MSS feeder link network to take certain actions to reduce interference to and from GSO FSS networks. Under a co-primary sharing arrangement, if the GSO FSS usage continues to increase, eventually the NGSO MSS feeder link network will reach its limit in its ability to minimize interference to and from GSO FSS systems such that it could not accommodate any new GSO FSS networks. Thus identifying a certain sub-band in the 17.7-19.7 GHz and 27.5-29.5 GHz bands for use primarily by NGSO MSS feeder links, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, may be a preferred option as it guarantees future access to all FSS applications. This second option would therefore entail the following:

- RR 2613 would be waived in those sub-bands identified for use primarily by NGSO MSS feeder link networks for MSS systems intending to operate service links in the 1-3 GHz MSS bands;
- accommodation of existing GSO FSS networks would be provided such that they would continue to have equal status with respect to NGSO MSS feeder link networks in those specific sub-bands;
- within these specific sub-bands, future GSO FSS networks would not cause harmful interference to, or receive protection from, NGSO MSS feeder link networks intending to operate service links in the 1-3 GHz MSS bands.

In addition to the above options, it is noted that when determining the FSS frequency allocations to be used for NGSO MSS feeder links, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, WRC-95 should take into account any NGSO MSS feeder link systems that are operational and notified in accordance with Articles 11 and 13.

Reverse Direction Allocation

In addition to the co-directional allocations, it may be possible to satisfy the requirements of the NGSO MSS feeder links, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, in the Earth-to-space direction in parts of

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the frequency ranges 18.4-18.6 GHz and 18.8-19.7 GHz (i.e., current FSS space-to-Earth allocations). Such use should be paired with a frequency sub-band below 17.7 GHz and the criteria for reverse direction transmission operation applied for bands below 17.7 GHz could be applied here (See Section 4.5.2.2.1). It is noted that the earth exploration-satellite and space research services (passive) are also allocated in the bands 18.6-18.8 GHz.

4.5.2.3 Changes To Article 11 and/or Resolution 46

Revisions should be made to Resolution 46 so that all of the procedures currently applied to GSO Fixed-Satellite Service will also be applied to NGSO MSS feeder link networks, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, in the appropriate frequency bands.

A thorough examination of Resolution 46 procedures shows that nothing in the current resolution precludes the coordination between NGSO MSS feeder links, between NGSO MSS feeder links and GSO FSS networks and between NGSO MSS feeder links and terrestrial stations from being undertaken, provided that:

- Article 8 clearly indicates the frequency bands in both directions of transmission, if required, either limited to NGSO MSS feeder links or shared on an equal basis by NGSO MSS feeder links and GSO FSS networks to which Resolution 46 would apply, and
- appropriate text is added to the Annex to Res. 46 to respectively cover the case of coordination of a NGSO feeder link station with a GSO earth station operated in the opposite direction, and the case of coordination of a GSO earth station with a NGSO feeder link station operated in the opposite direction.

This additional text is required to take account of the coordination between two earth stations operating services in bands allocated with equal rights in opposite directions. These coordination procedures have to be dealt with by the two

administrations on the territory of which the two earth stations potentially interfering with each other are located.

The transmit or receive coordination areas for the NGSO MSS feeder link earth station, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, with respect to Fixed Service stations and FSS earth stations could be determined in accordance with Recommendations ITU-R IS.847 and IS.849, suitably updated to reflect WRC-95 allocations. In cases where the coordination area extends beyond the territory of the Administration planning the feeder link earth station, the agreement of those administrations which have territory within either the transmit or the receive coordination area for the station would be required.

The current Section II to the Annex to Resolution 46 also covers implicitly the space-to-space coordination. For this particular case, it is possible to develop NGSO MSS satellite constellation PFD limits towards the GSO orbit, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, in order to protect GSO FSS receivers.

4.5.2.4 Changes to Article 29

The key factor in the use of the FSS frequency bands is the current provision RR 2613 and how the Bureau takes it into account in dealing with GSO FSS Networks, and NGSO feeder link networks.

While it may not be possible to find a single solution to the regulatory uncertainties addressed above, it is clear that provision RR 2613 by itself, whether modified or unchanged, will not be sufficient. Rather, it may be necessary, in addition to the specific allocation provision and footnotes discussed above, to modify for example RR 2613 itself and/or Articles 11 and 13 or Resolution 46 to make RR 2613 more effective; provisions giving specific instructions to the Bureau may be

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necessary. WRC-95 should decide the extent to which such additional changes are required in light of its decisions on the allocation issues above.

Further, for any allocations in RBW mode for use by NGSO MSS feeder links (space-to-Earth), for MSS systems intending to operate service links in the 1-3 GHz MSS bands, there is a need to include PFD limits at the GSO from the NGSO MSS feeder link satellites.

4.6 U.S. Proposals for MSS Feeder Link Spectrum for MSS Systems Intending to Operate Service Links in the 1-3 GHz MSS Bands

As was highlighted in the previous section on Regulatory Considerations, the accommodation of NGSO MSS feeder link spectrum requirements, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, can be addressed differently in the frequency ranges below and above 17.7 GHz. As such, the IWG-4 proposals presented in this section of the report are classified as proposals for frequency bands below and above 17.7 GHz.

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4.6.1 NGSO MSS Feeder Link Allocation Proposals for Frequency Bands Below 17.7 GHz for MSS Systems Intending to Operate Service Links in the 1-3 GHz MSS Bands[1]

This section contains the proposed NGSO MSS feeder link allocation proposals, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, for frequency bands below 17.7 GHz which should be included in the United States WRC-95 proposals. These allocations, along with the footnotes provided, will ensure that NGSO MSS systems intending to operate service links in the 1-3 GHz MSS bands, which require the use of feeder links below 17.7 GHz, will have access to sufficient spectrum. It is noted that footnotes to the Table utilizing the concept of

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[1] It is important to note, however, that terrestrial fixed microwave (FS) users and equipment manufacturers strongly disagree with the sharing of the 6 GHz, 11 GHz, and 18 GHz bands being recommended by IWG-4. The FS users are currently assigned these bands on a primary basis. They emphasize these bands, specifically the upper 6 GHz and 11 GHz bands will be the primary relocation bands for 2 GHz users who must move to clear spectrum for PCS. These bands are already saturated in several areas of the U.S. but are, nevertheless, expected to absorb the just described 2 GHz users. Further, the sharing being proposed, as seen by the users and manufacturers, will create critical technical problems that would make feeder links and FS incompatible. Superimposition of MSS feeder links upon the 6 GHz and 11 GHz bands particularly is considered as being unrealistic by the FS users and manufacturers.

Participants in the non-concurrence described above are ALCATEL Network Systems Inc. (ALCATEL), the American Petroleum Institute (API), the Associated Public Safety Communications Officials (APCO), the Association of American Railroads (AAR), AT&T Corp., Harris Corporation-Farinon Division (Harris), the Fixed Point-to-Point Communications Section, Network Equipment Division of the Telecommunications Industry Association (TIA) and UTC, The Telecommunications Association (UTC). These parties together represent manufacturing and user interests concerned with microwave spectrum allocations. All have filed Comments and Reply Comments in the Commission's WRC-95 proceeding (IC Docket No. 94-31) strongly stating their views on sharing with feeder links.

The participants indicated in the paragraph just above have advised they will be filing a separate "Statement of Non-Concurrence in the Final Report of IWG-4."

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"incorporation by reference" are illustrative only and subject to change when adoption of the concept and appropriate wording is finalized. If the "incorporation by reference" concept is not adopted, appropriate modifications or additions to regulatory provisions will have to be made. It is assumed that other regulatory footnotes have been further studied by IWG-1.

It is also noted that the attached allocation proposals provide for revisions to the allocation table for the 15.4-15.7 GHz band in both the Earth-to-space and space-to-Earth directions. After the issue of uplink/downlink pairing of feeder link frequencies is resolved, one or both of the allocation proposals for this band should be adopted. Early assessment of the feasibility of use in both directions of transmission by NGSO MSS feeder links, for MSS systems intending to operate service links in the 1-3 GHz MSS bands, indicate that sharing is probably feasible between these systems. The studies which led to this early assessment are still under review by U.S. government agencies and a final consensus has not yet been obtained. The NGSO MSS proponents intending to operate feeder links in the 15.4-15.7 GHz band will conduct and submit analysis to the appropriate fora to confirm the feasibility of this use.

The specification of the power flux density limit (-168 dBW/m^2/4 kHz) in the suggested new footnote VVV for the band 12.75-13.25 GHz and the absence of any such limit in connection with the suggested allocation for the NGSO MSS feeder links at 6650-7075 MHz (new footnote 792B) are inconsistent with the Report of the CPM-95 and the studies conducted by TG 4/5 with regard to protection requirements of GSO uplinks. Specifically, the CPM determined that in order to protect GSO satellites in the FSS (Earth-to-space) bands between 4 GHz and 16 GHz that are to be allocated for NGSO MSS feeder downlinks, the power flux density generated at the GSO by each NGSO network (i.e., constellation of NGSO satellites) should not exceed -168 dBW/m^2/4 kHz. In contrast, the suggested footnote VVV applies the limit of -168 dBW/m^2/4 kHz to individual NGSO satellites rather that the entire

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network, which could enable the GSO FSS interference criterion to be substantially exceeded. The power flux density limit currently applied to individual NGSO satellites with regard to a similar allocation situation at 8025-8400 MHz (FSS Earth-to-space and Earth Exploration-Satellite space-to-Earth) is -174 dBW/m^2/4 kHz (RR No. 2631), and in that case numerous NGSO satellites were not anticipated.

AMSC and others will be operating GSO feeder links in the frequency bands below 17.7 GHz. AMSC strongly recommends that should the Commission pursue allocations for NGSO MSS feeder links below 17.7 GHz on a reverse band basis, the PFD limits specified in the Report of the CPM-95 should be applied (see pages 47, 48 and 156 of CPM-95 Report). Specifically, the PFD limit of -168 dBW/m^2/4 kHz at the GSO should be applied to networks of NGSO MSS feeder downlinks (as opposed to individual satellites) operating in bands below 17.7 GHz.

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MOD

Allocation To Services		
Region 1	Region 2	Region 3
5000 - 5250	AERONAUTICAL RADIONAVIGATION FIXED-SATELLITE SERVICE (Earth-to-space) 797C 733 MOD 796 797 797B 797D 797E	

NOC 733 The bands 1 610-1 626.5 MHz, 5 000-5 250 MHz and 15.4-15.7 GHz are also allocated to the aeronautical mobile-satellite (R) service on a primary basis. Such use is subject to agreement obtained under the procedure set forth in Article 14.

MOD 796 The band 5030 - 5091 MHz is to be used for the operation of the international standard system (microwave landing system) for precision approach and landing. The requirements of this system shall take precedence over other uses of this band. Future operations of MLS may extend into the 5000 - 5030 MHz band. Administrations should attempt to satisfy the needs of MLS in the 5030 - 5091 MHz band before expansion into the 5000 - 5030 MHz band. After January 1, 2015, the microwave landing system may also operate in the band 5091 - 5120 MHz, if the requirements of the system in support of precision approach and landing cannot be met in the 5000 - 5030 and 5030 - 5091 MHz bands. In the event that microwave landing system operations extend beyond the 5030 - 5091 MHz band, the requirements of this system shall take precedence over other uses of the occupied bands.

NOC 797

SUP 797A The bands 5000-5250 MHz and 15.4-15.7 GHz are also allocated to the fixed-satellite service and the inter-satellite service, for connection between one or more earth stations at specified fixed points on the Earth and space stations, when these services are used in conjunction with the aeronautical radionavigation and/or aeronautical mobile(R) service. Such use shall be subject to agreement obtained under the procedure set forth in Article **14**.

NOC 797B

ADD 797C The use of the band 5000 - 5250 MHz (Earth-to-space) and 15.4 - 15.7 GHz (Earth-to-space) (space-to-Earth) by the fixed-satellite service is limited to feeder links for non-Geostationary satellite systems of the mobile-satellite service. The provisions of No. 2613 do not apply to these fixed-satellite service allocations.

ADD 797D The use of the bands 5000 - 5250 MHz (Earth-to-space) and 15.4-15.7 GHz (Earth-to-space) (space-to-Earth) by the fixed-satellite service is subject to the application of the coordination and notification procedures set forth in Resolution 46 [suitably modified], for coordination between non-Geostationary satellite networks (Earth-to-space) and between non-Geostationary satellite networks (Earth-to-space) and terrestrial services.

ADD 792E Stations of non-Geostationary fixed-satellite service networks (space-to-Earth) brought into use in the band 5000-5250 MHz after November xx, 1995 shall not claim protection from and shall not cause harmful interference to stations in the fixed-satellite service (Earth-to-space).

Reason: To allocate spectrum specifically for feeder links to support mobile-satellite services provided from non-Geostationary satellite networks. Suppression of No. 797A is consequential. Modification of No. 796 incorporates the alternative MLS expansion plan discussed internationally and articulates the transition plan with initial expansion (subject to need) into the 5000 - 5030 MHz band and subsequent expansion (subject to need) into the 5091 - 5120 MHz band. Nos. 797C and 797C add additional requirements when the bands are used by NGSO MSS feeder links, and indicate that RR 2613 does not apply in such cases.

5925-7075 MHz

Allocation to Services		
Region 1	Region 2	Region 3
5925 - 7075	FIXED FIXED-SATELLITE (Earth-to-space) 792A MOBILE 791 809 792B 792C ZZZ	

NOC 791 The standard frequency and time signal-satellite service may be authorized to use the frequency 4 202 MHz for space-to-Earth transmissions and the frequency 6 427 MHz for Earth-to-space transmissions. Such transmissions shall be confined within the limits of ± 2 MHz of these frequencies and shall be subject to agreement obtained under the procedure set forth in Article **14**.

NOC 792A The use of the bands 4500-4800 MHz, 6725-7025 MHz, 10.7-10.95 GHz, 11.2-11.45 GHz and 12.75-13.25 GHz by the fixed-satellite service shall be in accordance with the provisions Appendix **30B.**

ADD 792B The bands 6650-6725 MHz, 6725-7025 MHz and 7025-7075 MHz are also allocated on a primary basis to the fixed-satellite service (space-to-Earth). Such use by the fixed-satellite service (space-to-Earth) is limited to non-GSO mobile-satellite service feeder links and is subject to the application of the coordination and notification procedures set forth in Resolution 46. The provisions of RR 2613 do not apply to the use by the fixed-satellite service (space-to-Earth).

ADD 792C Stations of non-GSO fixed-satellite service networks (Earth-to-space) brought into use in the band 6875-7075 MHz after November xx, 1995 shall not claim protection from and shall not cause harmful interference to stations in the fixed-satellite service (space-to-Earth).

NOC 806 The band 5725-5875 MHz (center frequency 5800 MHz) is designated for industrial, scientific and medical (ISM) applications. Radiocommunication services operating within this band must accept harmful interference which may be caused by these applications. ISM equipment operating in this band is subject to the provisions of No.**1815**.

C00217

ADD ZZZ Coordination areas for receiving earth stations shall be determined using the methodology in the latest version of ITU-R Recommendation 848 in order to effect coordination of frequency assignments with those of transmitting earth stations, when appropriate. (alternative: revise Res. 46)

000218

10.7-11.7 GHz

Allocation to Services		
Region 1	Region 2	Region 3
10.7 - 11.7 FIXED FIXED-SATELLITE (space-to-Earth) 835A (Earth-to-space) WWW 792A 835 MOBILE except aeronautical mobile	10.7 - 11.7 FIXED FIXED-SATELLITE (space-to-Earth) 792A MOBILE except aeronautical mobile 835A WWW	

10.7 - 11.7

NOC 792A The use of the bands 4500-4800 MHz, 6725-7025 MHz, 10.7-10.95 GHz, 11.2-11.45 GHz and 12.75-13.25 GHz by the fixed-satellite service shall be in accordance with the provisions Appendix **30B.**

MOD 835 In Region 1, ~~the use of~~ the band 10.7-11.7 GHz may also be used on a primary basis by the fixed-satellite service (Earth-to-space) ~~is limited to~~ for feeder links for the broadcasting-satellite service.

ADD 835A The bands 10.7-10.95 GHz and 11.2-11.45 GHz are also allocated on a primary basis to the fixed-Satellite Service (FSS) (Earth-to-space). Except as provided in **RR 835**, such use by the FSS (Earth-to-space) is limited to non-Geostationary mobile-satellite service feeder links and is subject to the application of the coordination and notification procedures set forth in Resolution 46. The provisions of RR 2613 do not apply to the use by the FSS (Earth-to-space).

ADD WWW Coordination areas for transmitting earth stations shall be determined using the methodology in the latest version of ITU-R Recommendation 848 in order to effect coordination of frequency assignments with those of potentially affected receiving earth stations, when necessary. Administrations operating stations in the fixed-satellite service (Earth-to-space) are urged to facilitate frequency sharing with Fixed-satellite (space-to-Earth) networks.

Note: as an alternative to WWW, revisions may be made to Res. 46.

000219